Sevoflurane or halothane for induction in acute airway emergencies in children?

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INTRODUCTION

As children have much narrower airways than adults a small amount of swelling (from infection, inflammation or tumour) can lead to significant and rapidly progressive airway obstruction. Induction of anaesthesia and endotracheal intubation is sometimes required to secure the airway in an emergency.

THE IDEAL ANAESTHETIC APPROACH

A child in distress from acute upper airway obstruction should be moved to theatre and undergo a gradual induction with an inhalational agent in 100% oxygen. Full monitoring should be applied as and when possible and intravenous cannulation performed when the child is deeply anaesthetized to avoid potential laryngospasm. A gradual inhalational induction has the advantages of maintaining spontaneous respiration throughout and allows the gentle application of continuous positive airway pressure via a facemask, hence avoiding the potential loss of an already compromised airway. Once deeply anaesthetized the larynx can be visualized and endotracheal intubation performed with the child breathing spontaneously.

HALOTHANE OR SEVOFLURANE?

Halothane has been in clinical use since 1956. It has a blood–gas partition coefficient of 2.4 and a minimum alveolar concentration (MAC) of 0.75%. Sevoflurane was licensed for use in the USA in 1997. It's blood–gas partition coefficient is 0.66 and MAC is 2.5%.

Both halothane and sevoflurane are non-pungent and allow for a smooth induction with little risk of laryngospasm (Sarner et al, 1995). Sevoflurane at 1 MAC causes a greater depression in minute ventilation and respiratory frequency than 1 MAC halothane (Brown et al, 1998). More worryingly induction with 8% sevoflurane caused apnoea in 16% of adult patients (Thwaites et al, 1997). Apnoea is a potential disaster when anaesthetizing children with a difficult airway as it may lead to a 'can't intubate can't ventilate' scenario. However, a careful inhalational technique with small (1–2%) incremental increases in sevoflurane should avoid apnoea.

In infants halothane causes a greater decrease in heart rate, myocardial contractility and cardiac output than sevoflurane (Wodey et al, 1997). It also causes myocardial irritability especially in the presence of adrenaline and hypercarbia. Ventricular arrhythmias may thus be a significant problem if halothane is used to anaesthetize a terrified child who is hypercarbic because they are struggling to breath.

As sevoflurane has a significantly lower blood–gas partition coefficient than halothane it should give a more rapid induction of anaesthesia. However, Sarner et al (1995) reported excitement in 35% of children induced with sevoflurane and oxygen alone, which prolonged the time required to reach safe intubating conditions so that there was no difference with halothane. They stated that they 'found the omission of nitrous oxide during induction with sevoflurane to be unsatisfactory'. There are also concerns that a child anaesthetized with sevoflurane may 'lighten' too quickly during prolonged attempts at laryngoscopy and halothane would be safer because of its more prolonged action. A deeper depth of anaesthesia is also obtainable with halothane as its vaporiser allows up to 6.6 MAC to be given while the sevoflurane vaporiser delivers a maximum of 3.2 MAC.

The hepatotoxic properties of halothane are well known, whereas trifluoroacetic acid is not produced during the metabolism of sevoflurane.

Importantly many trainees would not have used halothane in the elective setting, so would have no experience with or 'feel' for the agent. It would be unwise to use an unfamiliar drug for the first time to anaesthetize a child with a 'difficult airway' in an emergency.

CONCLUSIONS

Halothane provides less haemodynamic stability than sevoflurane but is less likely to cause excitation and apnoea. It also allows a greater depth of anaesthesia to be reached and gives more time available for laryngoscopy. However, a major drawback of halothane is the increasingly widespread lack of clinical experience with its use. It may be best to stick to what you know. HM

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